AN11664

QN9020 Quick Start Guide

Rev. 1 — 5 June 2015 Application note

Document information

Info	Content
Keywords	Mini DK, SDK, installation, working mode, download, NVDS configuration, connect, GPIO configuration
Abstract	This application note discusses the use of the QN9020 mini development kit (Mini DK) for evaluating and developing Bluetooth Low Energy (BLE) solutions based on QN902X.

Revision history

Rev	Date	Description
v.1	20150605	Initial release

Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

1. Introduction

1.1 Overview

The QN9020 Mini Development Kit (Mini DK) is designed for evaluating and developing Bluetooth Low Energy (BLE) solutions based on QN902X. The purpose of this document is to give an overview of the hardware and software included in the QN9020 Mini DK. For more detailed information on BLE technology and software platform for QN9020, refer to *"QN9020 Software Developers Guide"*.

1.2 System requirements

1.2.1 System requirements

The QN9020 Mini DK has the following system requirements:

- a computer running with Windows XP, Windows 7 or Windows 8
- a computer with a minimum of 2 USB ports

Note: OS X (Mac) is not supported.

1.2.2 External resources

- Keil MDK-ARM
- JLink software

2. Contents of kit

2.1 Hardware

The QN9020 Mini DK contains the following hardware components:

- Mini DK board
- BLE dongle
- USB cable

The hardware components are shown in Figure 1.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

Fig 1. Hardware components of DK

Note: Mini DK can also be used for software development for QN9021. There is a difference between the GPIO for the QN9021 and the QN9020. For details, refer to the data sheet at http://www.nxp.com/documents/data_sheet/QN902X.pdf.

2.2 Software

The Software Development Kit (SDK) is named as QBlue-1.x.xx-setup.exe. After ordering, visit SDK customer support website https://www.collabnet.nxp.com to obtain the latest SDK package.

3. Getting started

3.1 System overview

The system consists of three parts (see Figure 2):

- Mini DK board: It is used for developing Bluetooth Low Energy (BLE) applications based on QN9020. It comprises on-board RF matching circuit and antenna, power supply, GPIO connector, buttons and LEDs. The JLink On-Board (OB) debugger is used to bridge QN9020 SWD and UART interface to PC, download program and debug from PC.
- BLE dongle: It is a Bluetooth Low Energy (BLE) device controlled by the QTool running on a PC. It works with the Mini DK as a pair for evaluation and debugging. It is connected to a PC via USB.
- QBlueStudio: It is a software tool chain to work with the Mini DK and BLE dongle.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

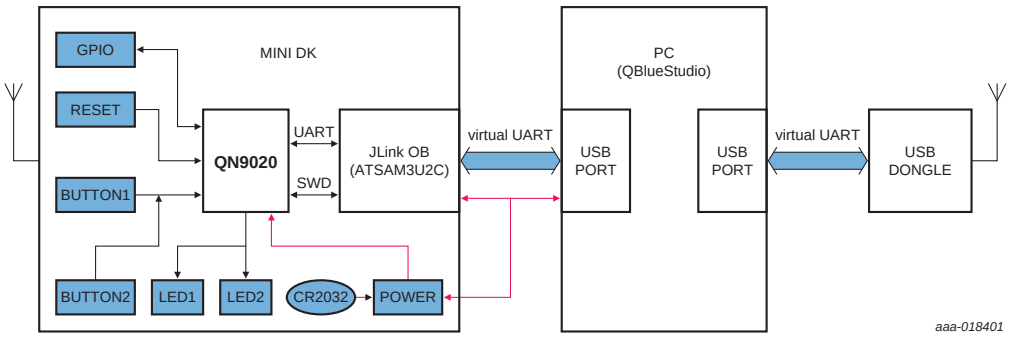


Fig 2. System model

3.2 Software installation

Before connecting the Mini DK Board to the computer, install Keil MDK-ARM or IAR, QBlue-x.x.x-setup.exe and Setup_JLink_Vxxx.exe. Keil is used in this document to show the instructions.

3.2.1 Keil MDK-ARM

Keil MDK-ARM can be downloaded and installed from the URL: https://www.keil.com/download/product; see Figure 3. Version 4.5 or newer is recommended.

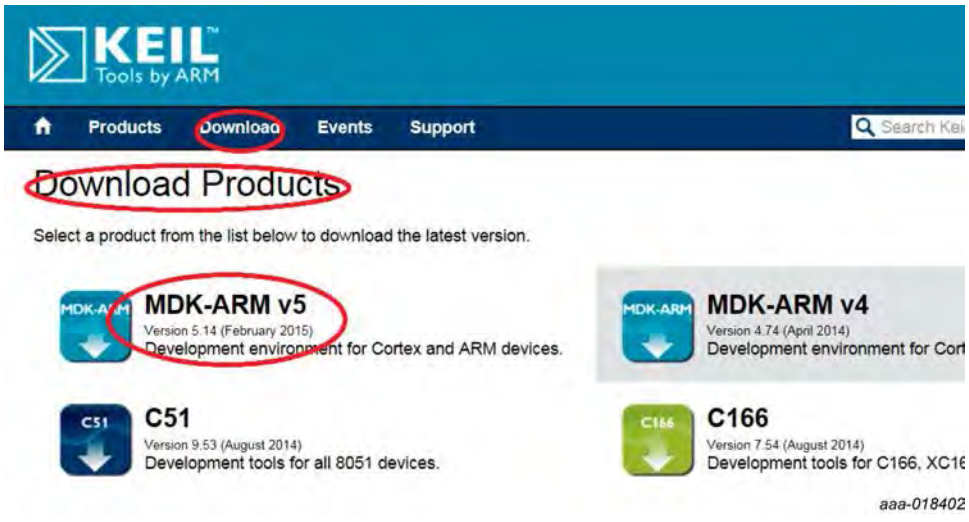


Fig 3. Download Keil MDK-ARM

3.2.2 QBlue-x.x.x-setup.exe

Install released SDK package QBlue-x.x.x-setup.exe.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

3.2.3 JLink software

Download and install Setup_JLink_Vxxx.exe (Version 4.6.6 or newer is recommended) from www.segger.com based on the development environment (see Figure 4). All Mini DK boards have their individual Segger ID (serial number) labeled at the back.

Home
RTOS and Middleware
J-Link Debug Probes
General Info
Software
Download
Adapters
Flash Breakpoints
Flash Download
J-Link OB
Model Overview
SDK
Supported CPUs and Devices
Supported IDEs
Compare US!
FAQs
Production Programmers
Evaluate our software!
Downloads
Debug Probes - J-Link and J-Trace
SEGGER J-Links are the most widely used line of debug probes available today. They've been proven for more than 10 years with over 250,000 units sold, including OEM versions and on-board solutions. This popularity stems from the unparalleled performance, extensive feature set, large number of supported CPUs, and compatibility with all popular development environments.
With up to 3 MBytes/s download speed to RAM and record breaking flashloaders, as well as the ability to set an unlimited number of breakpoints in flash memory of MCUs, the J-Link debug probes are undoubtedly the best choice to optimize your debugging and flash programming experience.
J-Link debug probes support all ARM 7/9/11, Cortex™, Microchip PIC32™, Renesas RX™ CPUs and are supported by all major IDEs such as IAR EWARM, Keil MDK, Rowley CrossWorks, Atollic TrueSTUDIO, IAR EWRX, Renesas HEW, Renesas e2studio, including GDB based IDEs, and many others.
Debug smarter and faster with J-Link debug probes!
Software and Documentation download
Subscribe to the J-Link software update notification list
The J-Link firmware was developed with SEGGER's own embedded software, giving its design a unique advantage.
aaa-018403

Fig 4. Location for JLink software

Note: The JLink software also contains a USB driver for JLink-OB.

3.3 Hardware Setup

3.3.1 Hardware Connection

Refer to "*QN9020 Mini DK User Guide*" for the usage of the Mini DK board.

3.3.2 Driver installation

Virtual COM Port (VCP) drivers make the USB device appear as an additional COM port on the PC. Application software accesses the USB device in the same way as it would access a standard COM port.

3.3.2.1 Driver for JLink-OB

Driver for JLink-OB is included in JLink software (see Section 3.2.3). It is installed automatically while installing the JLink software.

3.3.2.2 Driver for BLE Dongle

Refer to *Application Note AN-104* for detailed installation. It can be downloaded from FTDI website http://www.ftdichip.com/Support/Documents/AppNotes.htm

This guide helps with the installation of the FTDI's Combined Driver Model (CDM) driver for the Microsoft Windows operating system.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

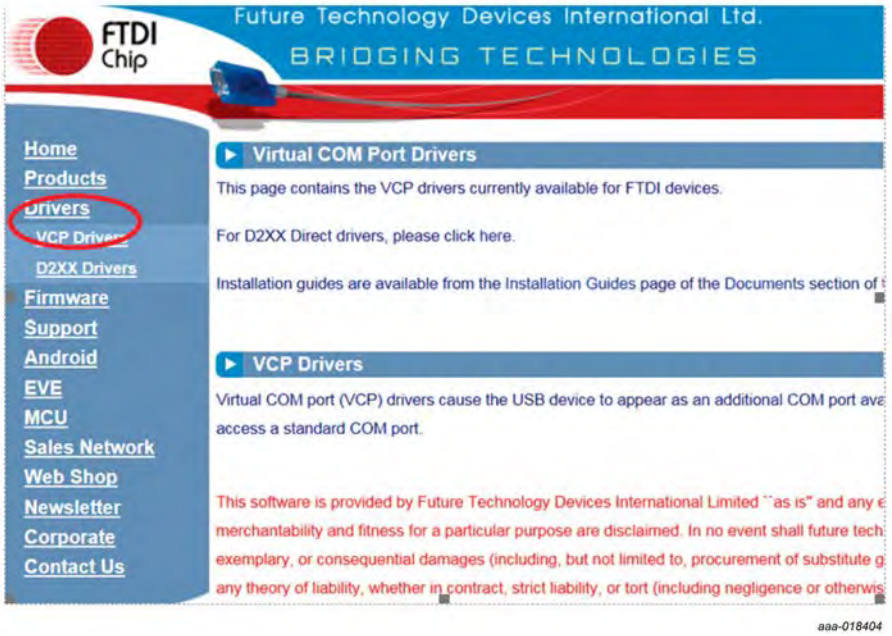

Future Technology Devices International Ltd.
FTDI Chip
BRIDGING TECHNOLOGIES
Home
Products
Drivers
VCP Drivers
D2XX Drivers
Firmware
Support
Android
EVE
MCU
Sales Network
Web Shop
Newsletter
Corporate
Contact Us
Virtual COM Port Drivers
This page contains the VCP drivers currently available for FTDI devices.
For D2XX Direct drivers, please click here.
Installation guides are available from the Installation Guides page of the Documents section of
VCP Drivers
Virtual COM port (VCP) drivers cause the USB device to appear as an additional COM port ava
access a standard COM port.
This software is provided by Future Technology Devices International Limited ``as is'' and any e
merchantability and fitness for a particular purpose are disclaimed. In no event shall future tech
exemplary, or consequential damages (including, but not limited to, procurement of substitute g
any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwis
aaa-018404

Fig 5. Driver location for BLE dongle

Installed drivers can be verified by checking the device manager in Windows OS (see Figure 6). Two COM ports are added to the list. One is the USB Serial Port (COM4) indicating the BLE Dongle. The other is a JLink CDC UART Port (COM5) for the JLink-OB on Mini DK board. The COM port number can be different for each computer. Therefore, it is always a good practice to check the ports with regards to the hardware connected.

Note: Ensue that the correct COM port number is used when downloading code and during evaluation using QTool. COM port assignments can be checked in the device manager.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

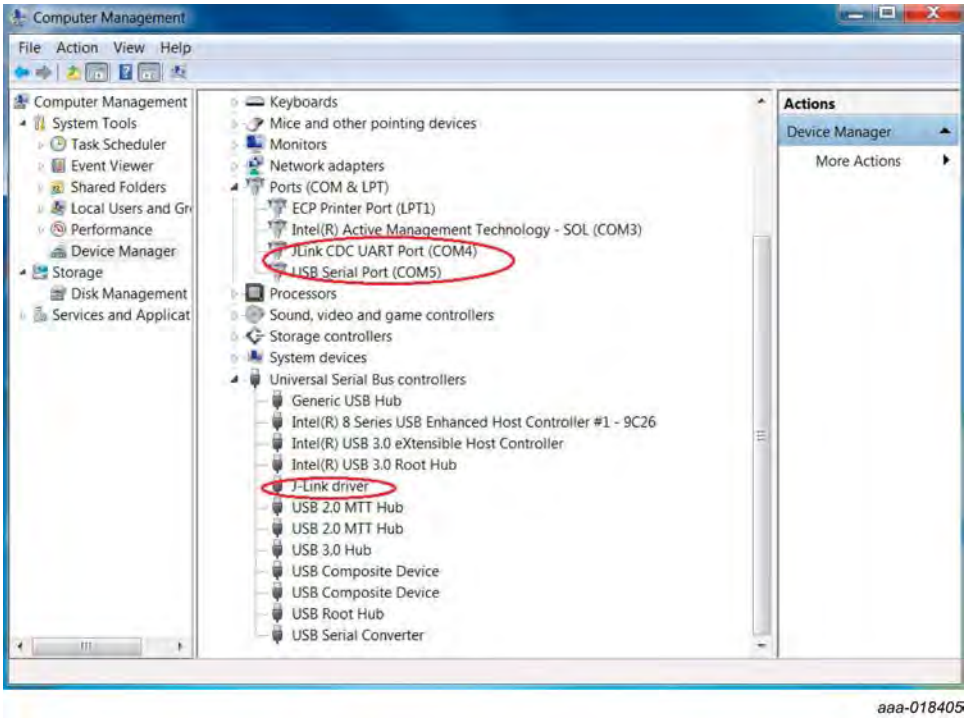


Fig 6. COM port of BLE dongle and JLink-OB

3.4 Working mode

QN9020 provides a flexible platform for wireless applications. It supports two working modes, Wireless SoC mode and Network processor mode. For detailed information related to the working modes, refer to *QN9020 Software Developers Guide*.

3.4.1 Wireless SoC mode

In the Wireless SoC mode, link layer, host protocol, profiles and application run on QN9020. Figure 7 shows how QN9020 is used in SoC mode. Application examples use the SoC mode.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

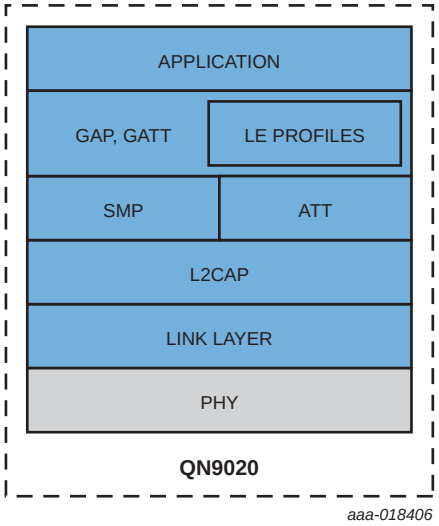


Fig 7. Wireless SoC mode

3.4.2 Network processor mode

In the Network processor mode, the link layer, host protocols and profiles run on QN9020 whereas the application runs on the external processor. The two components communicate via Easy ACI (Easy Application Controller Interface) over UART, provided in QN9020 SDK. For details, refer to the *QN9020 Easy ACI Programming Guide*.

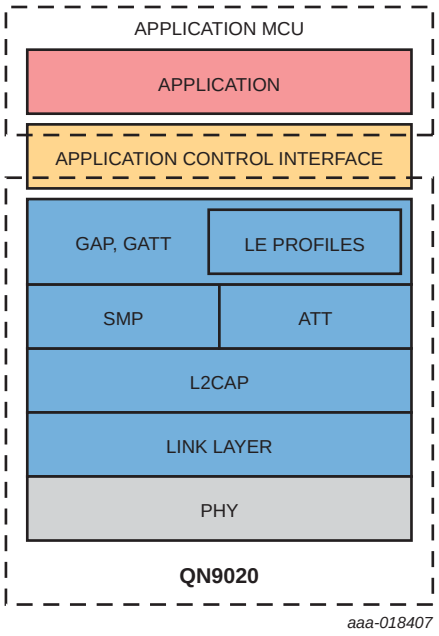


Fig 8. Network processor mode

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

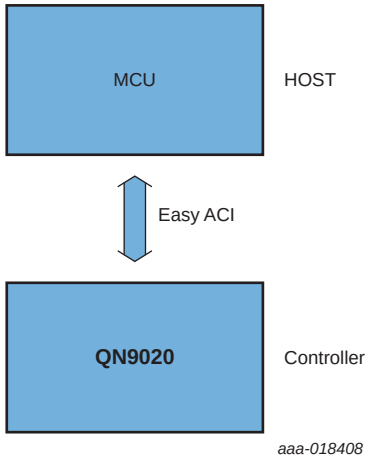


Fig 9. Easy ACI interface

4. Components of QBlue SDK

When QBlue SDK is installed and executed, it opens a GUI (see Figure 11) referred to as QBlueStudio. The GUI has links to various tools, BLE example codes, driver codes and detailed software/hardware guides.

4.1 SDK folder structure

Once installed, a folder is created in the main directory. The installation folder contains various subfolders as shown in Figure 10.

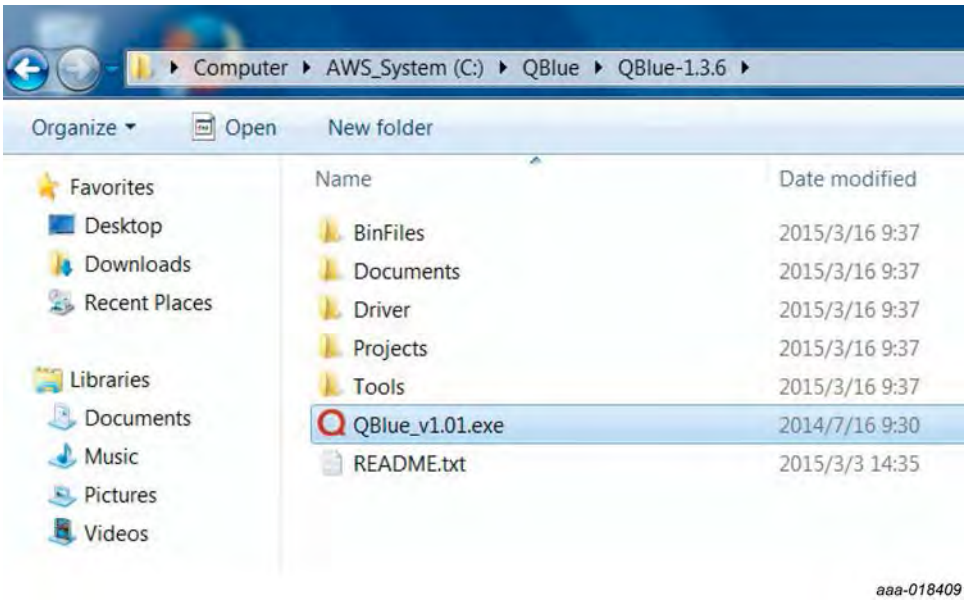


Fig 10. Qblue installation folder

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

4.1.1 BinFiles

This folder contains all binary files for sample applications provided in SDK.

4.1.2 Documents

Documents related to QN9020 SDK are found here.

4.1.3 Projects

This folder contains source code and project file in Keil and IAR for various BLE example applications.

4.1.4 Tools

This folder contains all tools with GUI in SDK to support application development.

4.2 Software components

QBlue SDK provides a GUI for users. Figure 11 shows the start page after launching QBlue.

Fig 11. QBlue start page

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

4.2.1 Tools

1. QTool: QTool is a PC tool that controls the BLE dongle. It allows the user to set up a connection between the BLE USB dongle and the other BLE device.

   A detailed user manual for the QTool can be found in the software documentation (*QTool User Manual*).
2. QBlueISPStudio: QBlueISPStudio is a tool to download application binary file, data file or NVDS configuration file into QN90xx series of BLE devices. Refer to *QBlue ISP Studio Manual* for more information.
3. QBlueNVDSConfigurator: It is a tool to add, edit and delete NVDS configuration data for BLE application development based on QN9020 platform. Refer to *QBlue NVDS Configurator Manual* for details.
4. QBlueDriverTools: It is a PC tool to make it easier to write peripheral driver code for BLE application development based on the QN9020 platform. Refer to *QN902x Driver Tools Manual* for further details.
5. Qn9020DevDBforIDE: This tool is used to add device database for QN9020 series chip into IDE, including ARM Keil MDK-ARM and IAR. Refer to *QN9020DevDBforIDE User Manual*.

4.2.2 Documents

Software Doc in the documents area leads directly to a software document folder described in Section 4.1.2.

4.2.3 Project

Projects area consists of three parts namely:

- BLE example: linked to the BLE folder under the Projects folder; see Section 4.1.3.
- Driver example: linked to the Driver folder under the Projects folder; see Section 4.1.3.
- Example bin files: linked to the BinFiles folder; see Section 4.1.1.

4.2.4 Support

It consists of links to website support pages to get support.

- Homepage - http://www.nxp.com/products/microcontrollers/product_series/
- Contact NXP support - http://www.nxp.com/support.html

5. Quick start with Demo

The QN9020 Mini DK board can be shipped with some pre-loaded profile. A proximity profile is used here as an example to demonstrate how to start with QBlue quickly. The proximity demo enables an interactive connection with BLE Dongle acting as a BLE master and Mini DK board as a slave.

Note: All Mini DK boards, are in a deep sleep mode when powered-up. It means that the debug ports do not respond. To debug or start advertising and eventually connect, press Button1 on the Mini DK.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.1 Download file

5.1.1 Steps to download file with QBlueISPStudio

5.1.1.1 Step 1:

Start QBlue.

5.1.1.2 Step 2:

Click ‘QBlueISPStudio’ on QBlue start page; see menu in Figure 12.

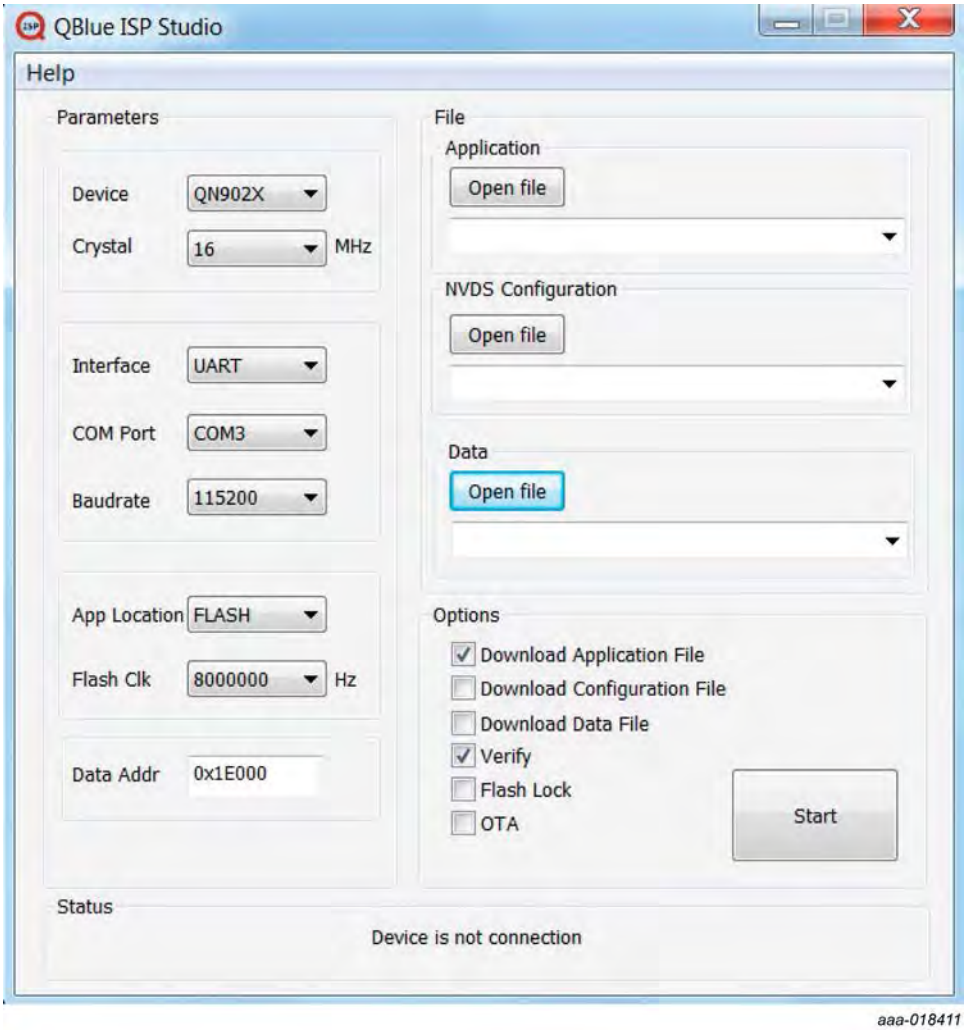


Fig 12. Setting ISP studio

5.1.1.3 Step 3:

Select UART interface and the correct COM port. Use the COM Port for JLink CDC UART port.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.1.1.4 Step 4:

Click “Open file” under Application to locate the bin file and choose “proxr.bin”. The demo bin files provided in QBlue SDK are located in C:\QBlue\QBlue-1.3.6\BinFiles.

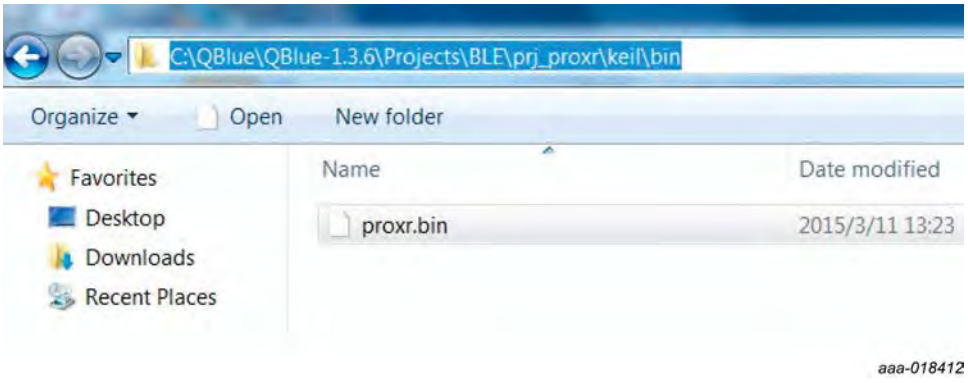


Fig 13. Proximity bin file

5.1.1.5 Step 5:

Click the “Start” button and then press the “RESET” button on the board (see Figure 14). The bin file is downloaded to board automatically, once the “RESET” button is released. If the download is successful, a message pops up; see Figure 15.

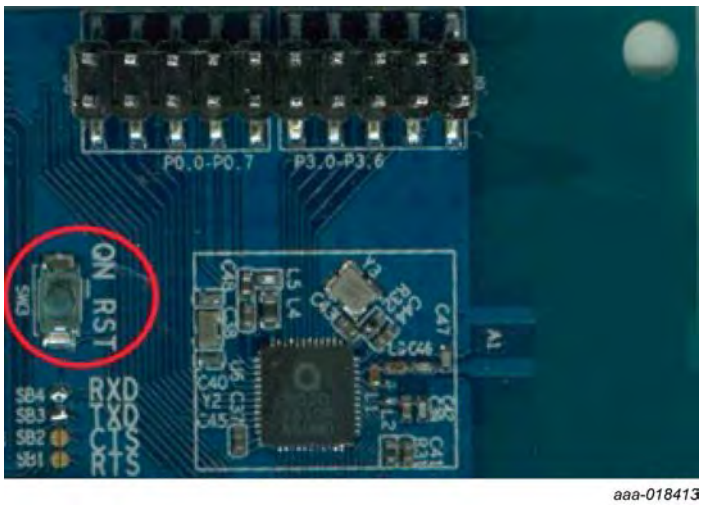


Fig 14. RESET button

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

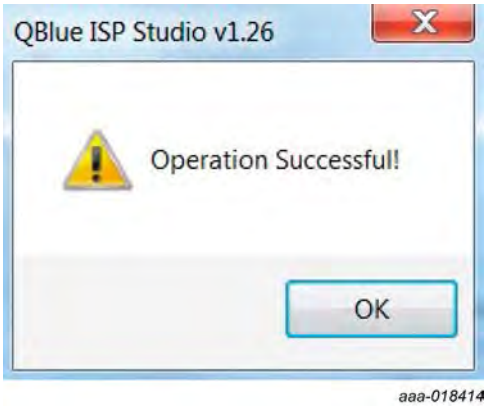


Fig 15. Download successful

If the bin file download fails, a message pops up (see Figure 16). If this occurs, perform the following:

1. Check the USB connection and whether LED1 and LED2 are ON.
2. Whenever the Start button is used to download files, press the RESET button on the Mini DK board to switch the board into boot mode, and then release it.
3. Make sure that the COM port setting is correct on the system. The setting can be found in device manager (see Figure 6).

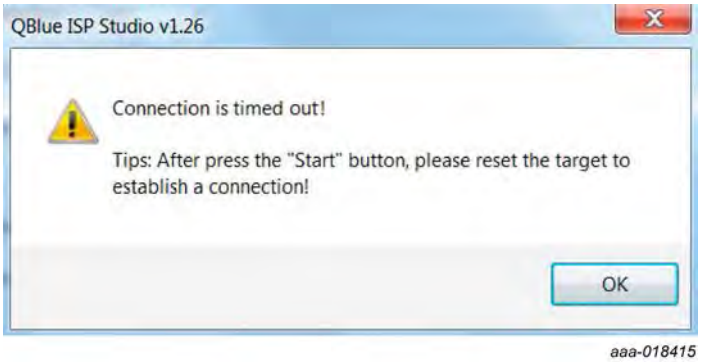

QBlue ISP Studio v1.26
Connection is timed out!
Tips: After press the "Start" button, please reset the target to establish a connection!
OK
aaa-018415

Fig 16. Failure message

For more information about the QBlueISPStudio tool, refer to the *QBlue ISP Studio Manual*.

5.1.2 Download file in Keil

Keil can also be used to download the compiled bin file. If QN9020 is in sleep mode while programming, press BUTTON1 or BUTTON2 to wake up Mini DK. Figure 17 and Figure 18 show the error messages that pop up when QN9020 is in sleep mode and the user is trying to program through Keil.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

Fig 17. Failure note

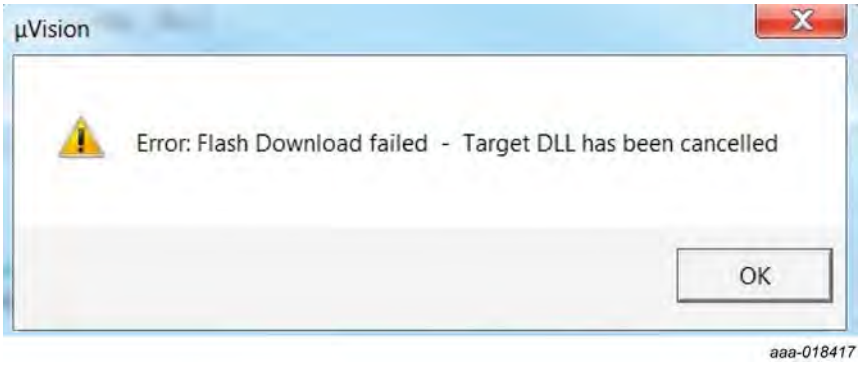


Fig 18. Failure note

5.2 Configure BLE device

Use NVDS configurator tool and configure the BLE device address, name, etc. This configuration data is stored in the NVDS area of flash. The NVDS configurator makes it easier to add, edit and delete the configuration data. The tool is also used to burn the configuration data to target chip, or dump it from the chip. For more information on this tool, refer to the *QBlue NVDS Configurator Manual*.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.2.1 Steps to configure BLE device

5.2.1.1 Step 1:

Click QBlueNVDSConfigurator button on QBlue start page to get NVDS configurator started; see Figure 19.

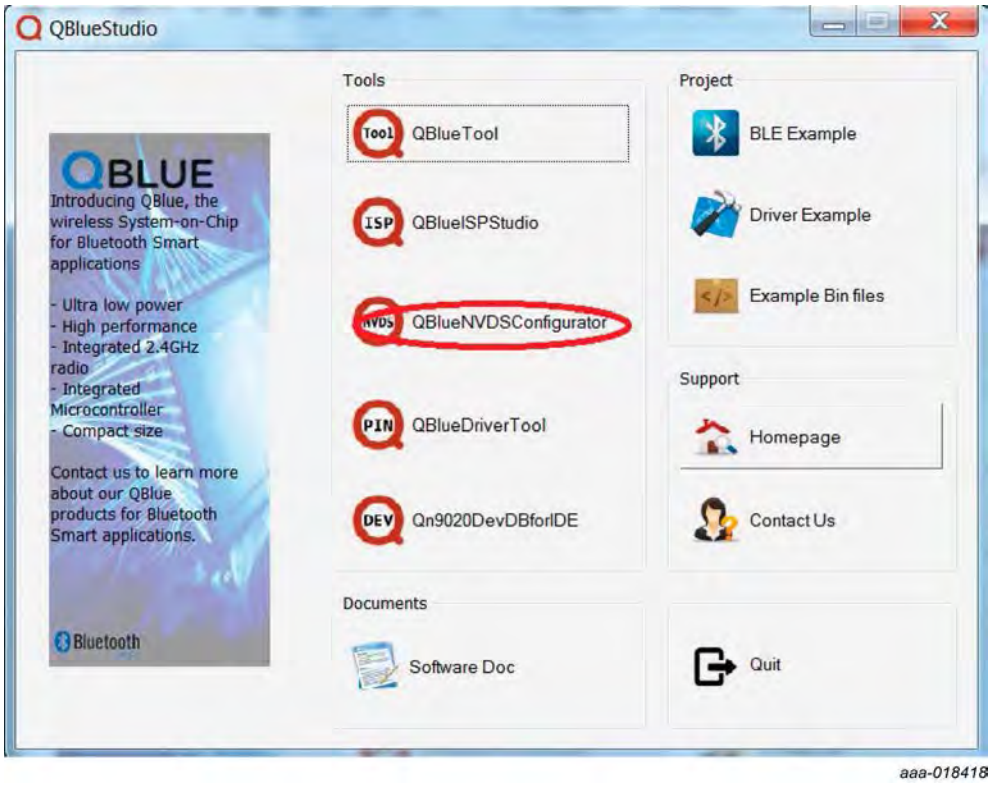


Fig 19. Start NVDS configurator

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.2.1.2 Step 2:

Choose the corresponding UART COM port and click connect button on the “Connect” dialog (see Figure 20).

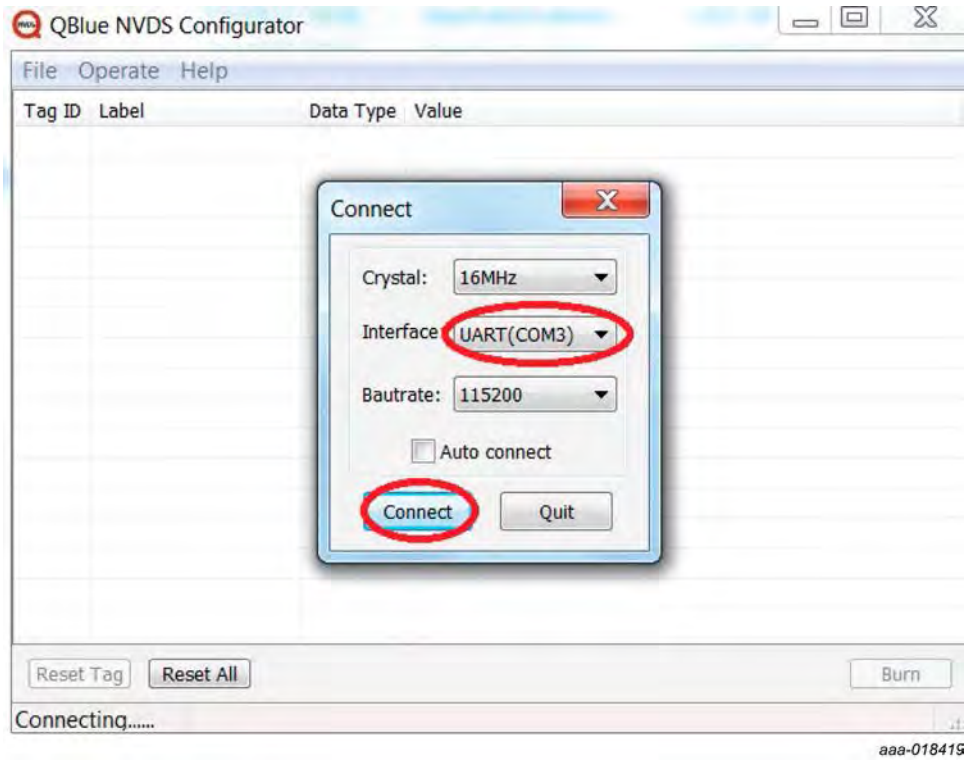


Fig 20. Set connection in NVDS

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.2.1.3 Step 3:

Press RESET button on the Mini DK board and then release it to connect the board (see Figure 14). Once connected, it shows configurable items (see Figure 21).

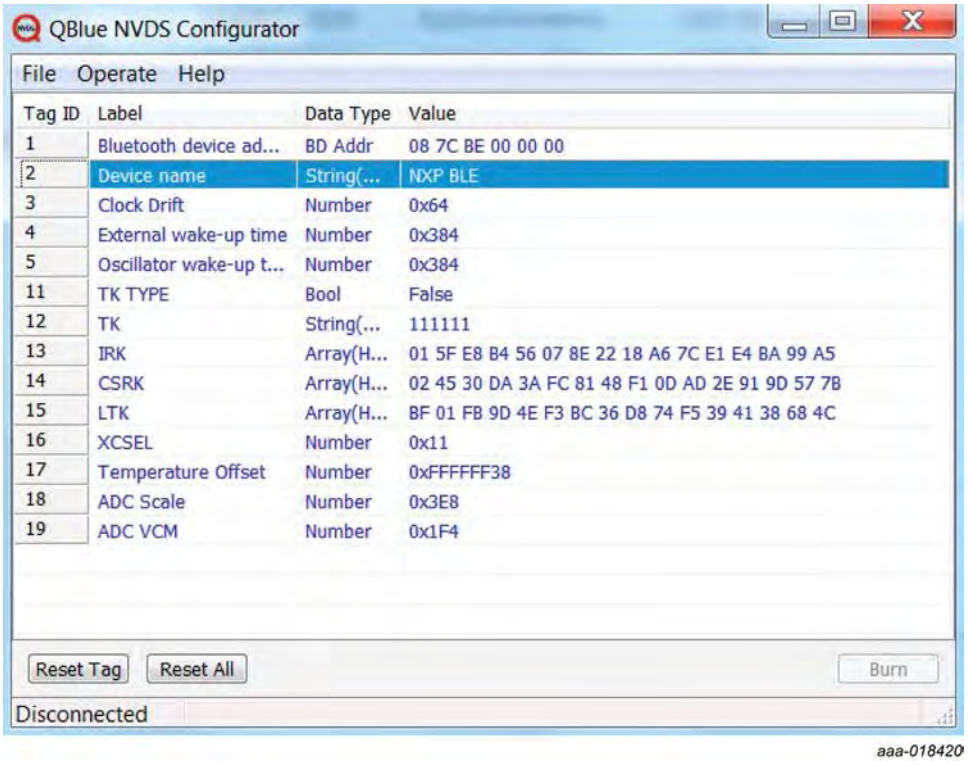

QBlue NVDS Configurator
File Operate Help
Tag ID Label Data Type Value
1 Bluetooth device ad... BD Addr 08 7C BE 00 00 00
2 Device name String(... NXP BLE
3 Clock Drift Number 0x64
4 External wake-up time Number 0x384
5 Oscillator wake-up t... Number 0x384
11 TK TYPE Bool False
12 TK String(... 111111
13 IRK Array(H... 01 5F E8 B4 56 07 8E 22 18 A6 7C E1 E4 BA 99 A5
14 CSRK Array(H... 02 45 30 DA 3A FC 81 48 F1 0D AD 2E 91 9D 57 7B
15 LTK Array(H... BF 01 FB 9D 4E F3 BC 36 D8 74 F5 39 41 38 68 4C
16 XCSEL Number 0x11
17 Temperature Offset Number 0xFFFFFF38
18 ADC Scale Number 0x3E8
19 ADC VCM Number 0x1F4
Reset Tag
Reset All
Burn
Disconnected
aaa-018420

Fig 21. NVDS configurator main window

The values can be changed according to specific requirement. However, the default value is recommended.

Table 1. Important items

Items	Description
Bluetooth device address	48-bit bluetooth device address.
Device name	name of the BLE device to differentiate from other Bluetooth devices.
Clock Drift	while using 32.768 kHz crystal oscillator, set it according to the specification of crystal used; recommended value is 100 ppm, to have margin for load variation and temperature change; while using 32 kHz RC oscillator, set it to 500 ppm.
External wake-up time /Oscillator wake-up time	900 μs (0x384) is recommended by default; while using 32 K low-power mode, it should be set as 3000 μs (0xBB8).
XCSEL	cap load of 16 MHz crystal oscillator; default value is 0x11; adjust according to the specific PCB design and crystal used in real applications.
ADC scale/ADC VCM	both parameters are for ADC and their values may be different for each chip; values are tested and calibrated while manufacturing.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.2.1.4 Step 4:

Click value field of device name record and change the device name (see Figure 22).

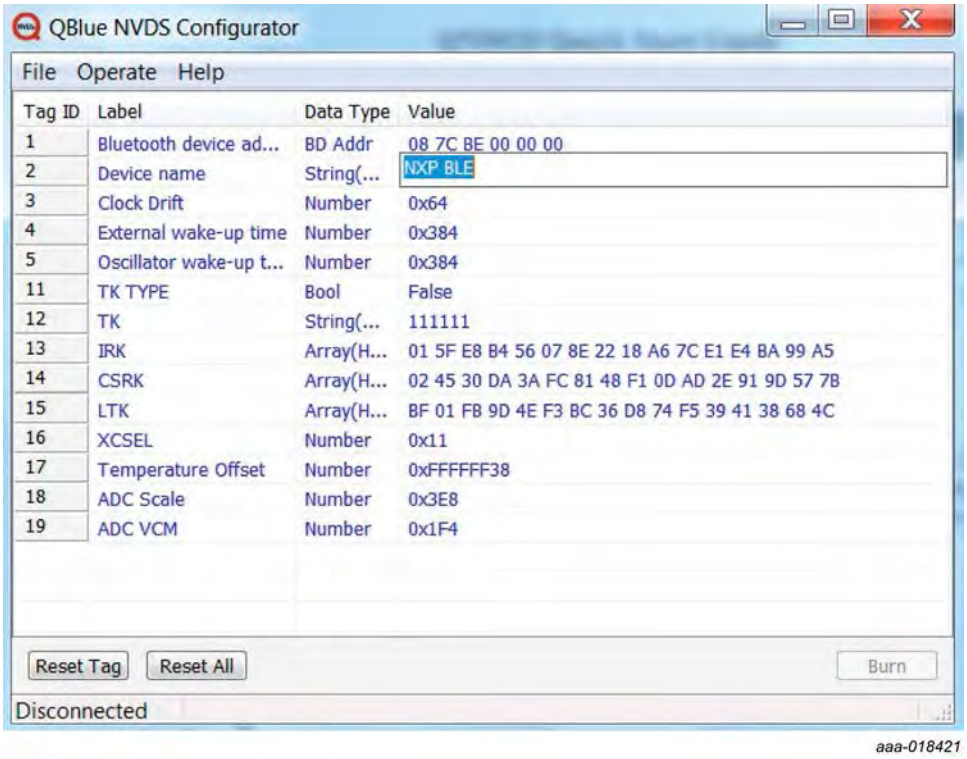

QBlue NVDS Configurator
File Operate Help
Tag ID Label Data Type Value
1 Bluetooth device ad... BD Addr 08 7C BE 00 00 00
2 Device name String(... NXP BLE
3 Clock Drift Number 0x64
4 External wake-up time Number 0x384
5 Oscillator wake-up t... Number 0x384
11 TK TYPE Bool False
12 TK String(... 111111
13 IRK Array(H... 01 5F E8 B4 56 07 8E 22 18 A6 7C E1 E4 BA 99 A5
14 CSRK Array(H... 02 45 30 DA 3A FC 81 48 F1 0D AD 2E 91 9D 57 7B
15 LTK Array(H... BF 01 FB 9D 4E F3 BC 36 D8 74 F5 39 41 38 68 4C
16 XCSEL Number 0x11
17 Temperature Offset Number 0xFFFFFF38
18 ADC Scale Number 0x3E8
19 ADC VCM Number 0x1F4
Reset Tag
Reset All
Burn
Disconnected
aaa-018421

Fig 22. Change device name

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.2.1.5 Step 5:

Click Burn button and write parameters back to QN9020 (see Figure 23).

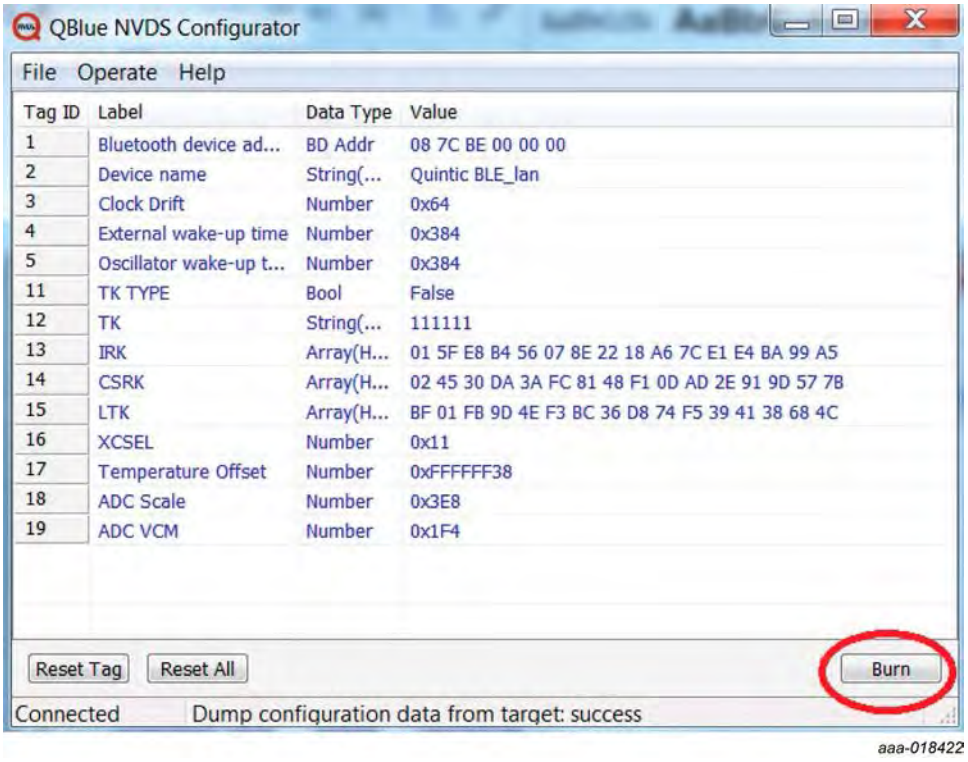

QBlue NVDS Configurator
File Operate Help
Tag ID Label Data Type Value
1 Bluetooth device ad... BD Addr 08 7C BE 00 00 00
2 Device name String(... Quintic BLE_lan
3 Clock Drift Number 0x64
4 External wake-up time Number 0x384
5 Oscillator wake-up t... Number 0x384
11 TK TYPE Bool False
12 TK String(... 111111
13 IRK Array(H... 01 5F E8 B4 56 07 8E 22 18 A6 7C E1 E4 BA 99 A5
14 CSRK Array(H... 02 45 30 DA 3A FC 81 48 F1 0D AD 2E 91 9D 57 7B
15 LTK Array(H... BF 01 FB 9D 4E F3 BC 36 D8 74 F5 39 41 38 68 4C
16 XCSEL Number 0x11
17 Temperature Offset Number 0xFFFFFF38
18 ADC Scale Number 0x3E8
19 ADC VCM Number 0x1F4
Reset Tag
Reset All
Burn
Connected
Dump configuration data from target: success
aaa-018422

Fig 23. Burn configuration

5.3 Connection

When the Mini DK board is powered-on or reset, it is in deep sleep mode. In this mode, LED2 is ON. The following are the LED indications:

- LED1 ON: It indicates that the application is connected. If it is flickering, it means that it is advertising.
- LED2 ON: It indicates that QN9020 is in the deep sleep state.

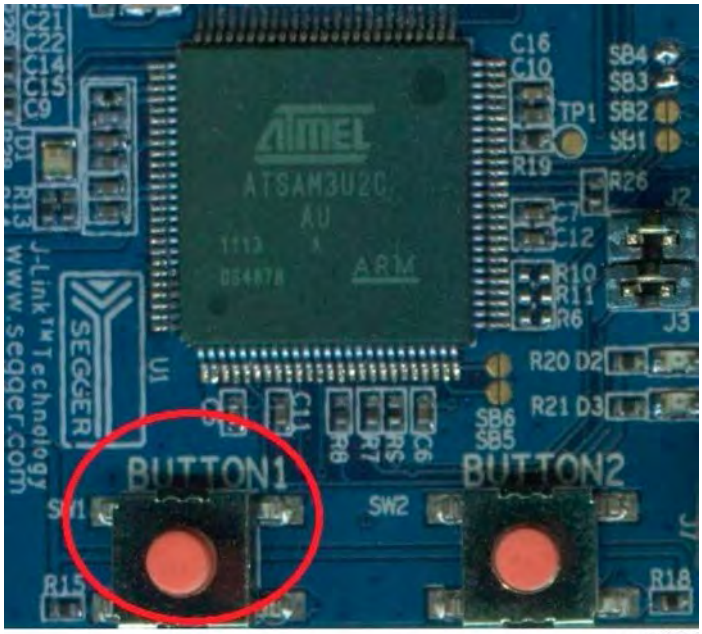
5.3.1 Steps to set up the connection between the Mini DK board and BLE dongle

5.3.1.1 Step 1:

Press BUTTON1 as shown in Figure 24, to take the board into advertising state and make it discoverable. The LED1 now starts flickering. The flashing frequency depends on the advertising interval. For the first 30 seconds, the application uses a short advertising interval. After 30 seconds, LED1 flashing frequency will be lower as the advertising interval has increased to around 1 sec. If BUTTON1 is pressed again, the application stops advertising and LED1 stops flashing. The application is back to deep sleep state.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

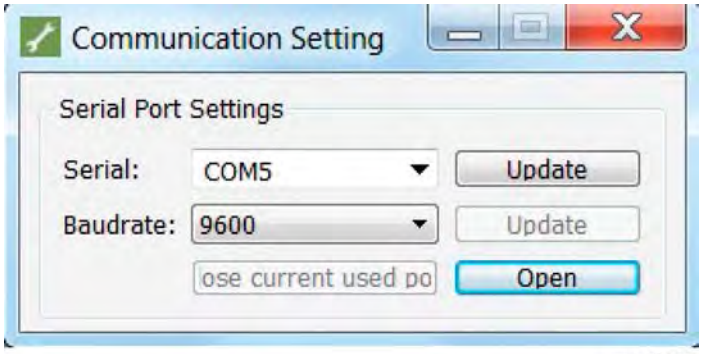


aaa-018423

Fig 24. BUTTON1

5.3.1.2 Step 2:

Step 2: Start QTool from QBlue start page. Figure 25 shows the message that pops up for communication setting.



aaa-018424

Fig 25. Connection setting in QTool

5.3.1.3 Step 3:

Select the correct COM port for BLE Dongle. It can be checked with the device manager. Press ‘Open’ button in the dialog box. Figure 26 shows the resultant window. The device representing BLE Dongle would be in idle state by default.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

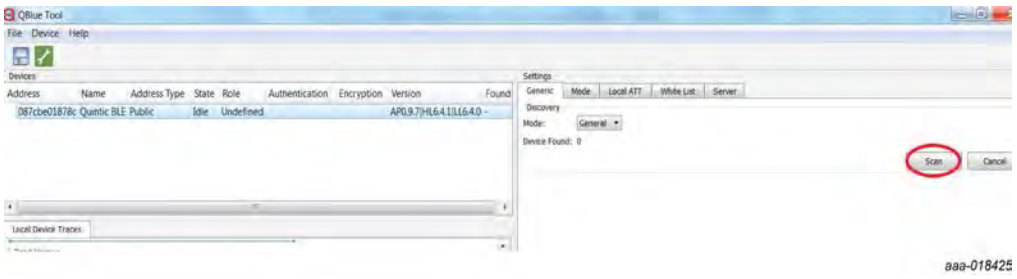


Fig 26. QTool opened

5.3.1.4 Step 4:

Select the item in Devices. It shows the Settings area.

5.3.1.5 Step 5:

To switch it to advertising mode, press BUTTON1 on Mini DK board and press scan button shown in Figure 26. The discovered devices are now shown in Devices area.

5.3.1.6 Step 6:

To initiate a connection, select the Mini DK from the scan result and click the Connect button in Settings block (see Figure 27).

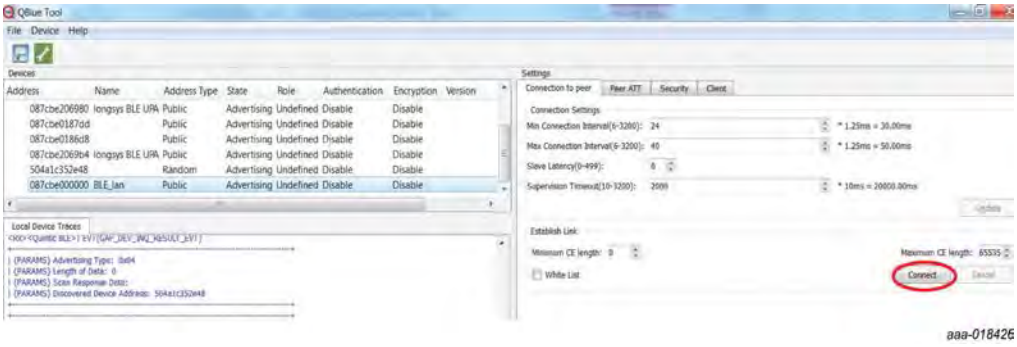

QBlue Tool
File Device Help
Devices
Address Name Address Type State Role Authentication Encryption Version
087cbe206980 longsys BLE UPA Public Advertising Undefined Disable Disable
087cbe0187dd Public Advertising Undefined Disable Disable
087cbe0186d8 Public Advertising Undefined Disable Disable
087cbe2069b4 longsys BLE UPA Public Advertising Undefined Disable Disable
504a1c352e48 Random Advertising Undefined Disable Disable
087cbe000000 BLE_lan Public Advertising Undefined Disable Disable
Settings
Connection to peer Peer ATT Security Client
Connection Settings
Min Connection Interval(6-3200): 24
Max Connection Interval(6-3200): 40
Slave Latency(0-499): 0
Supervision Timeout(10-3200): 2000
Establish Link
White List
Connect
Local Device Traces
aaa-018426

Fig 27. Connection in QTool

The role of BLE Dongle changes to master and the Mini DK board acts as slave. The state of both devices is connected as shown in Figure 28.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

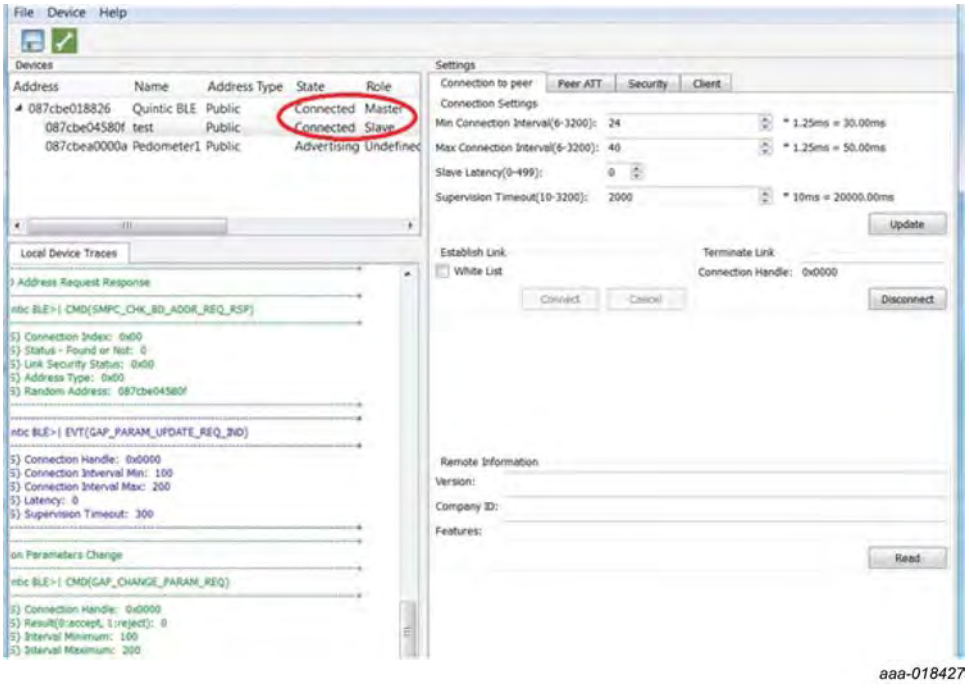


Fig 28. Devices connected

5.4 Function operation

Various interactions between Mini DK board and BLE Dongle can be performed when connected.

5.4.1 Find me

Steps to simulate “to find the Mini DK board”:

5.4.1.1 Step 1:

Click “Client” tab and “PROXM” tab in Settings area (see Figure 29).

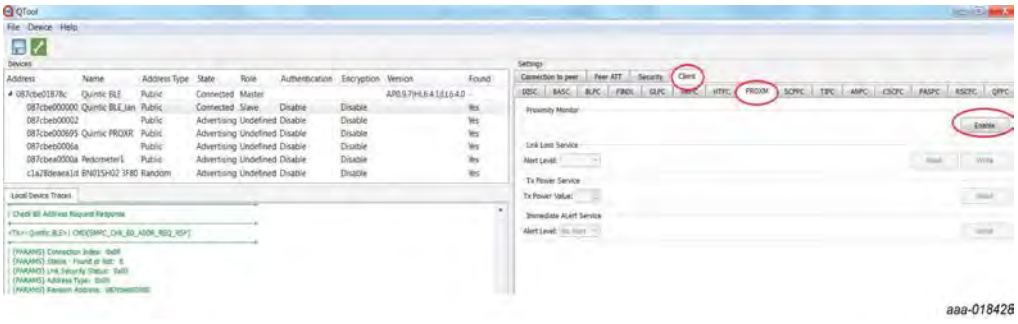


Fig 29. PROXM app discovered

5.4.1.2 Step 2:

To make discovered services editable, click the Enable button.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

5.4.1.3 Step 3:

Set the alert level in the Immediate Alert Service area to Medium or High.

5.4.1.4 Step 4:

Click “Write” button. The Mini DK board sounds an alert with the help of a Buzzer. Proximity alerts are indicated using the Buzzer. The volume of the buzzer indicates the type of alert.

5.4.2 Disconnect

1. Click “disconnect” button in “Connection to peer” tab (see Figure 28). The device disconnects with no response.
2. If the two devices are moved away from each other, the RF link may break. In such a case, the Mini DK board responds with an alert.

5.4.3 Others

When buzzer is ON, press BUTTON2 to turn-off the buzzer.

6. Advanced application development

According to specific requirement, it may be necessary to add some peripheral functions such as Button, LED and Buzzer. Useful tools are provided to help with implementation. It is easier to implement specific functions observing the sample codes in QBlue SDK.

6.1 Add driver file

Suppose that it is required to implement button control, which needs GPIO definition. It is easy to implement it by using the Keil development tool. By default, there is a folder named “driver” at *C:\QBlue\QBlue-x.x.x\Projects\BLE\src*. All peripheral function source codes are included here. The relevant driver files can be added to the project in Keil, as shown in Figure 30.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

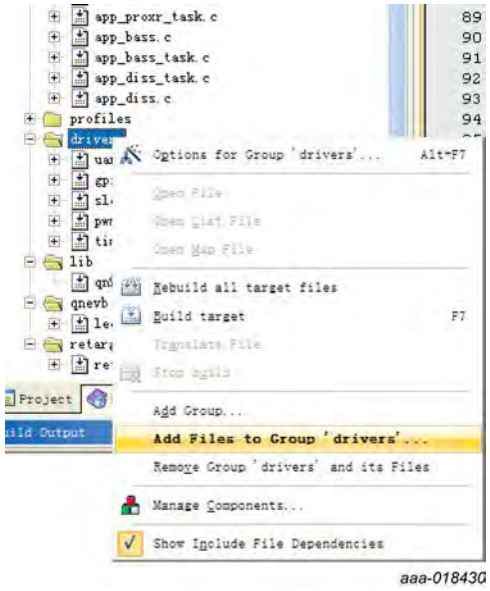


Fig 30. Adding a driver file

To study how to use the peripheral functions, open the dedicated peripheral driver files, typically located in “C:\QBlue\QBlue-x.x.x\Projects\Driver”. Open the required project and directly download to the Mini DK board. Modify it according to the specific requirements.

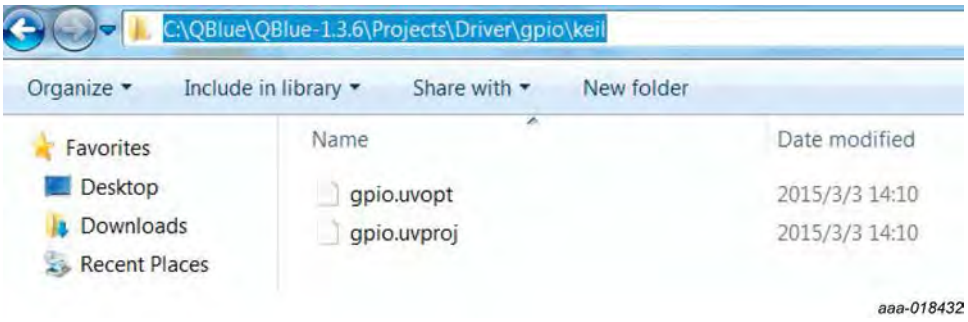


Fig 31. Adding a driver file

Double-click “gpio.uvproj” and open it using Keil (see Figure 32).

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

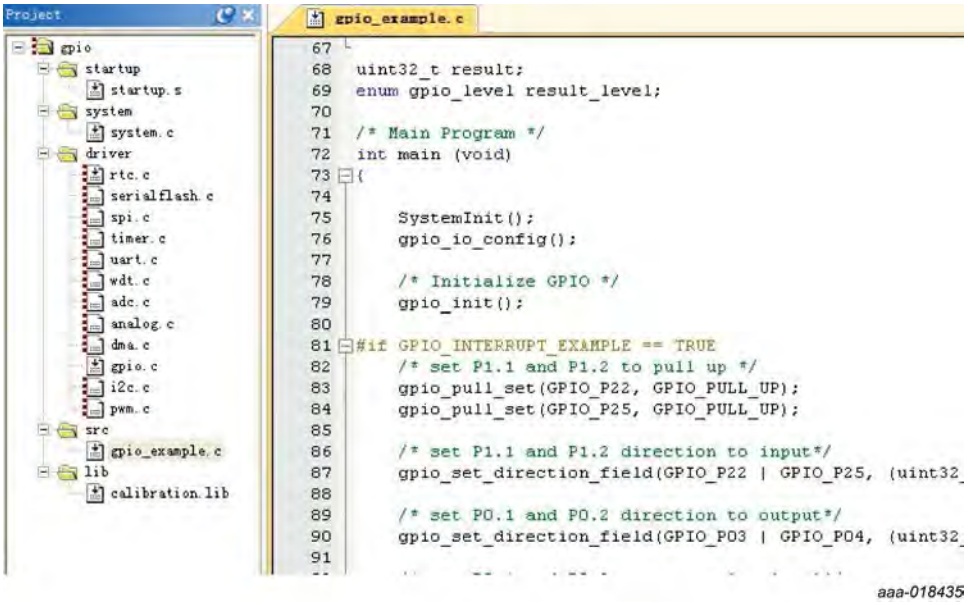


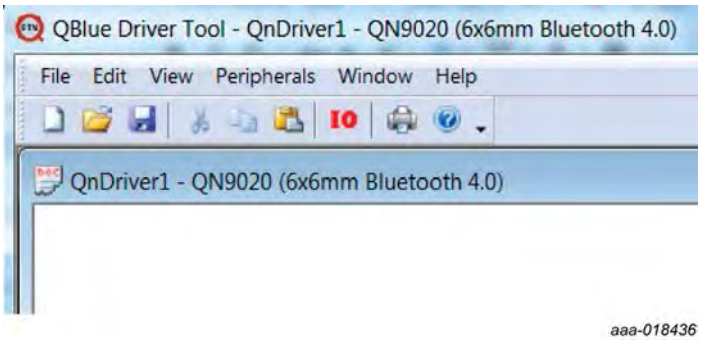
Fig 32. GPIO example

The main function is in gpio_example.c.

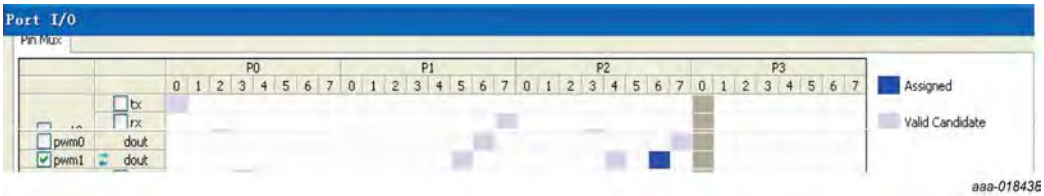
6.2 GPIO MUX Configuration

The GPIO pins are shared with digital or analog peripherals such as SPI, UART, I^{2}C, and ADC. The function of IO can be configured in QBlueQriverTools, which generates the source code for the specific assignment of GPIO pins.

1. Change GPIO function
   a. Open “QBlueDriverTool” and choose “IO” icon as shown below.


QBlue Driver Tool - QnDriver1 - QN9020 (6x6mm Bluetooth 4.0)
File Edit View Peripherals Window Help
IO
QnDriver1 - QN9020 (6x6mm Bluetooth 4.0)
aaa-018436

   b. Select P2.6, and P2.6 as PWM function.



All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

c. After the setting is completed, click button OK at the bottom right of the “QBlueDriverTools” window. The source code is generated automatically as shown below.

```
//Pin Mux Control Register
syscon_SetPMCR0(QN_SYSCON, P00_GPIO_3_PIN_CTRL
                         | P03_GPIO_2_PIN_CTRL
                         | P05_GPIO_15_PIN_CTRL
                         | P06_SW_DAT_PIN_CTRL
                         | P07_SW_CLK_PIN_CTRL
                         | P10_GPIO_8_PIN_CTRL
                         | P11_GPIO_7_PIN_CTRL
                         | P12_GPIO_6_PIN_CTRL
                         | P13_GPIO_5_PIN_CTRL
                         | P17_GPIO_4_PIN_CTRL
                         | P23_GPIO_12_PIN_CTRL
                         | P24_GPIO_11_PIN_CTRL
                         | P26_PWM1_PIN_CTRL
                         | P27_GPIO_9_PIN_CTRL
                         | P31_GPIO_14_PIN_CTRL
                         | P32_GPIO_13_PIN_CTRL);

//Pin Mux Control Register
syscon_SetPMCR1(QN_SYSCON, P01_GPIO_18_PIN_CTRL
                         | P02_GPIO_17_PIN_CTRL
```

aaa-018439

2. Add PWM function to Project

Open “system.c” which is located at “C:\QBlue\QBlue-x.x.x\Projects\BLE\prj_proxr\src” by default.

Find “P26_GPIO_10_PIN_CTRL” in function “SystemIOCfg” and replace it with “P26_PWM1_PIN_CTRL”. Save this file.

After adding above code to current project, compile the project, and download it to Mini DK board to confirm the functionality.

Note:

1. For more information about how to enable related module, refer to example code at “C:\QBlue\QBlue-x.x.x\Projects\Driver\adc\keil”.

2. For more information on “QBlueDriverTools”, refer to *QBlue Driver Tools Manual*.

7. Trouble shooting

1. Bin file download failed while using QBlueISPStudio (see Section 5.1.1.5).
2. Bin file download failed while using Keil: Set the board in active mode and download again (see Section 5.1.2).
3. Error messages pop up while downloading application to Mini DK board: Press BUTTON1 or BUTTON2 to wake up the board and download again (see Section 5.1.2).

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

8. Abbreviations

Table 2. Abbreviations

Acronymn	Description
DK	Development kit
SoC	System on Chip
BLE	Bluetooth Low Energy
SMP	Security Management Protocol
GPIO	General Purpose Input Output
ACI	Application Control Interface
EACI	Easy Application Control Interface
ISP	In System Programming
SPI	Serial Port Interface
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver/Transmitter

9. References

Released with SDK:

- *QN9020 Easy ACI Programming Guide*
- *QBlue QTool User Manual*
- *QBlue ISP Studio Manual*
- *QBlue NVDS Configurator Manual*
- *QBlue Driver Tools Manual*
- *QN9020DevDBforIDE User Manual*

Released in Customer Support Website:

- *QN9020 Software Developers Guide*
- *QN9020_Mini_DK_User_Guide*

Others:

1. http://www.keil.com/uvision/debug.asp
2. https://www.segger.com
3. https://www.keil.com

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

10. Legal information

10.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

10.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer.

In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages.

Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

10.3 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

I²C-bus — logo is a trademark of NXP Semiconductors N.V.

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

11. Tables

Table 1. Important items 19
Table 2. Abbreviations 29

12. Figures

Fig 1. Hardware components of DK 4
Fig 2. System model 5
Fig 3. Download Keil MDK-ARM 5
Fig 4. Location for JLink software 6
Fig 5. Driver location for BLE dongle 7
Fig 6. COM port of BLE dongle and JLink-OB 8
Fig 7. Wireless SoC mode 9
Fig 8. Network processor mode 9
Fig 9. Easy ACI interface 10
Fig 10. Qblue installation folder 10
Fig 11. QBlue start page 11
Fig 12. Setting ISP studio 13
Fig 13. Proximity bin file 14
Fig 14. RESET button 14
Fig 15. Download successful 15
Fig 16. Failure message 15
Fig 17. Failure note 16
Fig 18. Failure note 16
Fig 19. Start NVDS configurator 17
Fig 20. Set connection in NVDS 18
Fig 21. NVDS configurator main window 19
Fig 22. Change device name 20
Fig 23. Burn configuration 21
Fig 24. BUTTON1 22
Fig 25. Connection setting in QTool 22
Fig 26. QTool opened 23
Fig 27. Connection in QTool 23
Fig 28. Devices connected 24
Fig 29. PROXM app discovered 24
Fig 30. Adding a driver file 26
Fig 31. Adding a driver file 26
Fig 32. GPIO example 27

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2015. All rights reserved.

13. Contents

1 Introduction . . . 3
1.1 Overview . . . 3
1.2 System requirements . . . 3
1.2.1 System requirements . . . 3
1.2.2 External resources . . . 3
2 Contents of kit . . . 3
2.1 Hardware . . . 3
2.2 Software . . . 4
3 Getting started . . . 4
3.1 System overview . . . 4
3.2 Software installation . . . 5
3.2.1 Keil MDK-ARM . . . 5
3.2.2 QBlue-x.x.x-setup.exe . . . 5
3.2.3 JLink software . . . 6
3.3 Hardware Setup . . . 6
3.3.1 Hardware Connection . . . 6
3.3.2 Driver installation . . . 6
3.3.2.1 Driver for JLink-OB . . . 6
3.3.2.2 Driver for BLE Dongle . . . 6
3.4 Working mode . . . 8
3.4.1 Wireless SoC mode . . . 8
3.4.2 Network processor mode . . . 9
4 Components of QBlue SDK . . . 10
4.1 SDK folder structure . . . 10
4.1.1 BinFiles . . . 11
4.1.2 Documents . . . 11
4.1.3 Projects . . . 11
4.1.4 Tools . . . 11
4.2 Software components . . . 11
4.2.1 Tools . . . 12
4.2.2 Documents . . . 12
4.2.3 Project . . . 12
4.2.4 Support . . . 12
5 Quick start with Demo . . . 12
5.1 Download file . . . 13
5.1.1 Steps to download file with QBlueISPStudio . . . 13
5.1.1.1 Step 1: . . . 13
5.1.1.2 Step 2: . . . 13
5.1.1.3 Step 3: . . . 13
5.1.1.4 Step 4: . . . 14
5.1.1.5 Step 5: . . . 14
5.1.2 Download file in Keil . . . 15
5.2 Configure BLE device . . . 16
5.2.1 Steps to configure BLE device . . . 17
5.2.1.1 Step 1: . . . 17
5.2.1.2 Step 2: . . . 18
5.2.1.3 Step 3: . . . 19
5.2.1.4 Step 4: . . . 20
5.2.1.5 Step 5: . . . 21
5.3 Connection . . . 21
5.3.1 Steps to set up the connection between the Mini DK board and BLE dongle . . . 21
5.3.1.1 Step 1: . . . 21
5.3.1.2 Step 2: . . . 22
5.3.1.3 Step 3: . . . 22
5.3.1.4 Step 4: . . . 23
5.3.1.5 Step 5: . . . 23
5.3.1.6 Step 6: . . . 23
5.4 Function operation . . . 24
5.4.1 Find me . . . 24
5.4.1.1 Step 1: . . . 24
5.4.1.2 Step 2: . . . 24
5.4.1.3 Step 3: . . . 25
5.4.1.4 Step 4: . . . 25
5.4.2 Disconnect . . . 25
5.4.3 Others . . . 25
6 Advanced application development . . . 25
6.1 Add driver file . . . 25
6.2 GPIO MUX Configuration . . . 27
7 Trouble shooting . . . 28
8 Abbreviations . . . 29
9 References . . . 29
10 Legal information . . . 30
10.1 Definitions . . . 30
10.2 Disclaimers . . . 30
10.3 Trademarks . . . 30
11 Tables . . . 31
12 Figures . . . 31
13 Contents . . . 32

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP Semiconductors N.V. 2015. All rights reserved.

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 5 June 2015
Document identifier: AN11664